Kerala Government's Hi-Tech School Programme Implementation

A Report by:

Supported by

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The broader research project titled **Educational Technology Implementation in Teaching and Learning** is an Ohio University Institutional Review Board (IRB) approved study (IRB number: 16-E-248). As part of the IRB approval process, all researchers completed International Research Ethics and Compliance Training to protect the rights of the participants.

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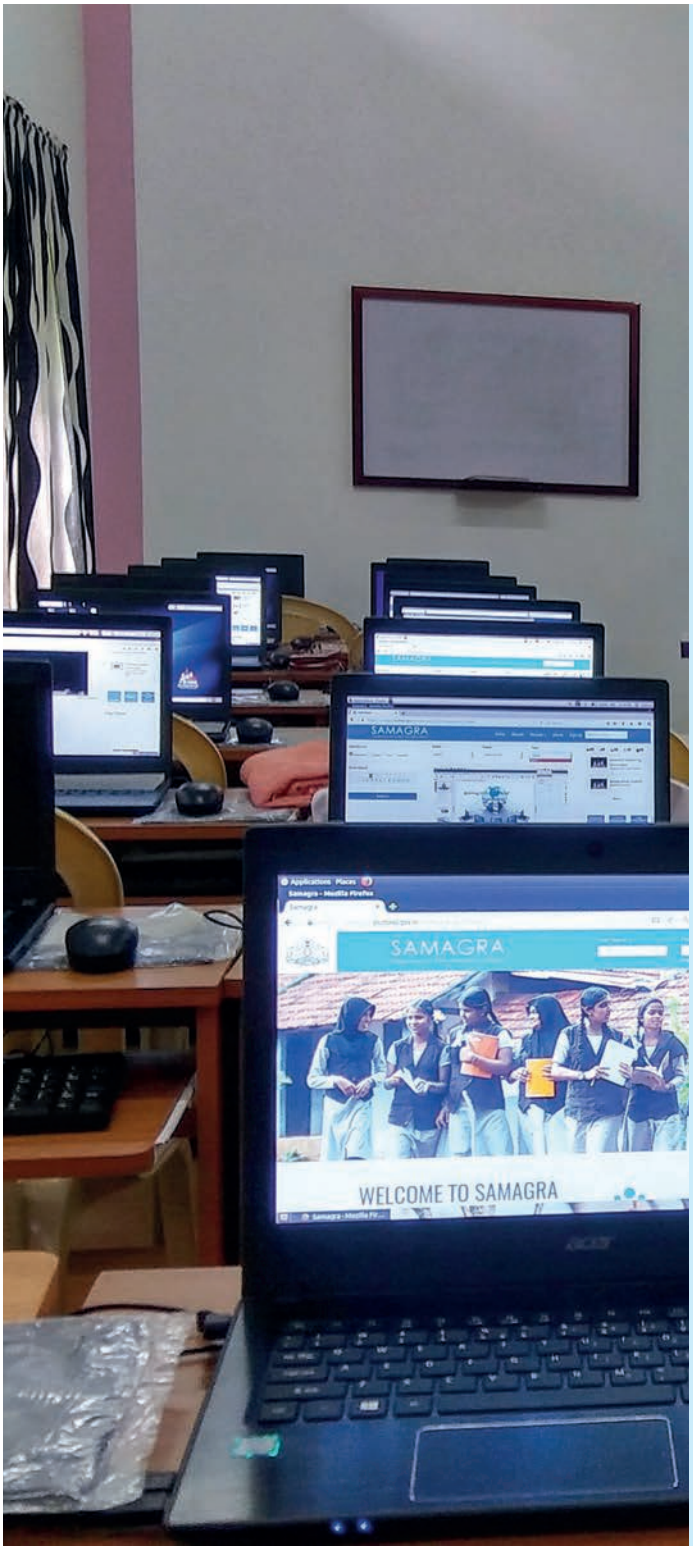

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EXECUTIVE SUMMARY

Over the last two decades, KITE (Kerala Infrastructure and Technology for Education), formerly known as IT@School Project, implemented several Educational Technology projects to meet society's rising dependence on technology in teaching and learning. This report provides insights into the implementation of KITE's Hi-Tech School Programme.

Using the Concerns-Based Adoption Model (CBAM) to assess the implementation of the new programme, the study examined teachers' 'Stages of Concerns' and the 'Level of Use' regarding the use of technology-enabled instruction in teaching and learning in Kerala, India.

Our major findings and conclusions include the following:

- From the 4,752 Hi-Tech School Programme implemented schools, 11,351 teachers completed the online survey with a 94 percent completion rate. As part of the interviews, 10 schools were selected from urban and rural settings, and 27 interviews were conducted.
- Stages of Concern: The teachers' concerns were high in Stage 2 (Personal), Stage 3 (Management), and Stage 6 (Refocusing). In particular, teachers reported concerns about time, logistics, and the coordination of technology-enabled instruction.
- Level of Use: Out of the total number of teachers (10,176), 71.35 percent reported levels of use indicating minimal concern (these include the categories of Renewal, Integration, Refinement, and Routine Use);

28.65 percent of teachers reported levels of use that indicated greater concern (these include Mechanical Use, Orientation, and Nonuse).

- Technology Access and Usage: 92 percent of teachers reported they have access to either a computer, computer lab, or laptop cart in their classroom for teaching and learning. Teachers reported daily use of Computers (59 percent), Internet (60 percent), and Smartphones (63 percent) for teaching and learning.
- Teachers reported that the main benefits of using technology were to increase student motivation and reinforce or expand concepts being taught. Online videos and images are the most often used technology resources to support or supplement teaching.
- The most often cited infrastructural concerns were power failure and loss of internet connection.

In conclusion, we found that the new technology has great potential to improve and enrich teaching and student learning. Some of this potential can already be seen and measured in the responses of teachers and through direct classroom observation. Of course, when implementing new technologies, discomfort is inevitable among teachers who are more comfortable with the traditional method of teaching. Teachers' Personal and Management concerns can be reduced by providing customised training with a focus on the school and district level. In sum, despite the prevalence of infrastructural concerns, KITE has made significant improvements in teaching and learning by implementing the Hi-Tech School Programme in Kerala, India.

INTRODUCTION

Background

Information and Communication Technology (ICT) plays a vital role in contemporary education, preparing and empowering today's students for life in an information-based society.

The State Government of Kerala, India, created KITE (Kerala Infrastructure and Technology for Education) in 2001 to help modernize educational institutions state-wide. KITE programs help schools across Kerala address Content Development, Capacity Building, Connectivity, Satellite-based education, e-Learning, and more. To date, KITE has implemented across 45,000 Hi-Tech classrooms in 4,752 schools with a net positive effect on the state's educational system. KITE has received overwhelmingly positive feedback from thousands of teachers and schools and is quickly becoming an essential part of the Kerala classroom environment. The use of ICT in classrooms has improved student participation and activity, held student interest, increased student knowledge retention, and helped students improve across a range of subjects.

To continue scaling ICT adoption — and to share learnings with other states — the State Government of Kerala partnered with Ohio University and the University of Kerala in 2019 and conducted research to assess the implementation and integration of KITE programs from the teacher's perspective. Teacher attitudes are critical to the implementation of any classroom technology initiatives, and a frequent problem in educational settings is that the innovation is often introduced by outside decision makers and by demands from central, state and district authorities, without understanding the perceptions or concerns of teachers (Hall & Hord, 1987, 2011). For this study, researchers surveyed, interviewed, and observed a wide range of secondary and post-secondary teachers in Kerala using a Concerns Based Adoption Model (see pg 20 and figure 1).

Goals of the Study

- Assess the implementation and integration of ICT-enabled instruction into the curriculum and teaching practices in Kerala schools.
- Evaluate teachers' perceptions of program successes and learn from teacher concerns.
- Provide key learnings and actionable insights to other state educational authorities.
- Gain data that can inform the implementation of existing and future KITE programs.

Stage of Concern	Typical Statement
0 Unconcerned	"I think I heard something about it, but I'm too busy right now with other priorities to be concerned about it."
1 Informational	"This seems interesting, and I would like to know more about it."
2 Personal	"I'm concerned about the changes I'll need to make in my routines."
3 Management	"I'm concerned about how much time it takes to get ready to teach with this new approach."
4 Consequence	"How will this new approach affect my students?"
5 Collaboration	"I'm looking forward to sharing some ideas about it with other teachers."
6 Refocusing	"I have some ideas about something that would work even better."

Figure 1. Seven Stages of Concern

THE SETTING OF THE STUDY

Figure 2.
Map of India
(Survey of India)

About India

With a population of more than one billion people, India is home to nearly 18 percent of the world's total population living on less than three percent of the world's total land area. In addition to its high population density, the country is marked by considerable diversity in languages (22 are officially recognized by the Indian constitution) and religions (including Hinduism, Islam, Christianity, Sikhism, and Jainism).

The Indian education system is one of the largest in the world. According to the most recent data published by the Department of School Education and Literacy (MHRD 2020), the all-India totals for primary, upper primary, secondary, and higher secondary schools come to more than 1.55 million schools (15.5 lakh schools), 9.4 million teachers (94 lakh teachers), and 247.8 million students (24.78 crores students). Though Hindi is the national language, in higher education English is the predominant medium of instruction. In primary (elementary) and secondary schools, English is a mandatory language, except in Bihar (a state in eastern India). An average Indian child learns three languages: Hindi, English, and mother tongue (a regional language) (Thankachan, 2013).

About Kerala

Kerala is a 392-mile (631km) long strip of land in southwestern India, facing the Arabian Sea. Figure 2 presents the geographic position of Kerala on the map of India.

The total population in the state is 33,387,677, which is three times that of Ohio, although the area is less than half of Ohio's (15,000 sq. miles). The population density is 2,123 people per sq. mile (859 per sq. km), which is the third highest in the country.

For administrative purposes, Kerala is divided into fourteen revenue districts with Trivandrum as the state capital. Kerala is the most literate state in India with a 93 percent literacy rate. Furthermore, Kerala has made remarkable progress on indicators of social development (e.g., education and medical facilities).

Courtesy: www.mapsofindia.com

KITE
(KERALA INFRASTRUCTURE AND TECHNOLOGY FOR EDUCATION)

KITE (Kerala Infrastructure and Technology for Education), formerly known as the IT@ School Project, is an entity established by the Government of Kerala. It was set up to foster, promote, and implement the modernisation of educational institutions in Kerala with a focus on hi-tech programmes.

KITE also helps in upgrading the infrastructure facilities in schools. KITE's primary functions include providing information and communication technology, content development, capacity building, connectivity, satellite-based education, support and maintenance mechanisms, e- learning, e-governance, and related activities. In addition, innovative KITE programmes help to improve the infrastructure, resources, curriculum, facilities, and pedagogy of Kerala educational institutions to ensure that they are on par with international standards. Samagra, Sametham, KOOL, Little Kites, Victers, Sampoornna, and School wiki are among the various Hi-Tech School initiatives that KITE has implemented across 45,000 Hi-Tech classrooms in 4,752 schools (KITE, 2020).

HI-TECH SCHOOL PROGRAMME

The Hi-Tech school programme is a major highlight of the Public Education Rejuvenation Mission of the Govt. of Kerala. This programme aimed at upgrading all classrooms to international standards. As the leading pioneer of ICT-enabled education in the State of Kerala for over a decade, KITE has been the primary implementing agency for the programme. The 4,752 schools mentioned above include Govt & Aided High Schools and Higher Secondary Schools. The Hi-Tech classrooms are equipped with Laptop, HDMI Cables and Faceplates, Whiteboard / Projection Screen, USB Speakers, ceiling mounted Multimedia Projector, High Speed Broadband internet and access to Samagra Resource Portal. The Hi-Tech IT Labs feature Laptops, Multifunction Printers and Sound system. Additionally, each of the 4,752 schools were provided with a 42-inch LED TV, a DSLR Camera and Full HD webcam. The classrooms and IT Labs have been connected by a network through a Central server in the Lab and it allows the sharing of information (KITE, 2020).

KITE has developed SAMAGRA Resource Portal. It functions as a repository of educational contents for the students from first grade to twelfth grade. Samagra features e-Resources, Textbooks and Question Banks in the

form of images, animations, videos, tutorials and interactive narrations. At present Samagra has over 25,000 digital resources, in four mediums of instruction: English, Malayalam, Tamil and Kannada. VICTERS (Versatile ICT Resource for Students) is an educational channel which is accessed by a large majority of schools in Kerala. VICTERS is transmitted through local cable networks and it covers 80 percent of the households in the state. VICTERS channel is telecasted from 6a.m to 11p.m (17 hours a day) (KITE, 2020). The components of the Hi-Tech School Project are given in Figure 3.

45,000
classrooms

4,752
schools

25,000
digital resources

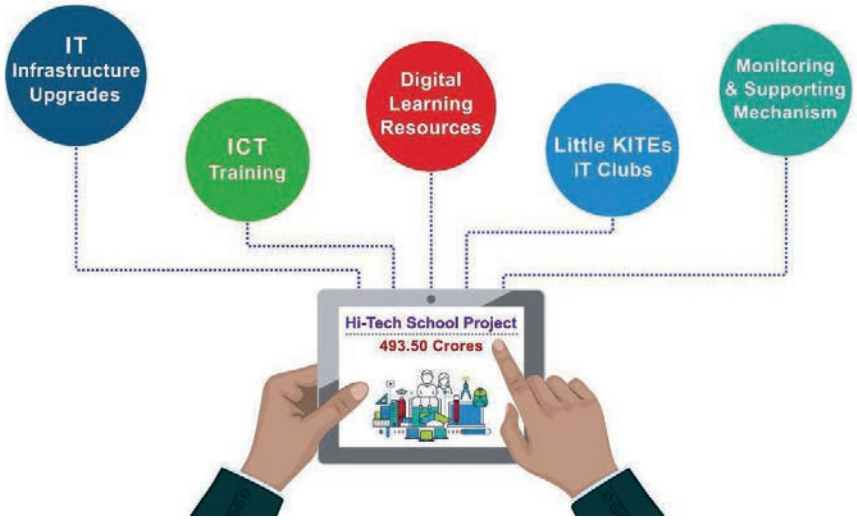


Figure 3.
Components of Hi-Tech School Project

77,194
trained teachers

1,990
high schools

KITE has successfully made a pilot implementation of the Hi-Tech School Programme in 139 selected schools in four constituencies – Alappuzha, Puthukkad, Kozhikode North and Thaliparamb. It includes the Seven Smart Schools during 2016-2017 (KITE, 2020).

KITE has imparted ICT-based training to 77,194 teachers from High School, Higher Secondary, Vocational Higher Secondary and Upper Primary sections to supplement the Hi-Tech School programme. About 52,150 students from 1,990 High Schools, who are the members of Little KITEs Clubs, were also trained in different domains such as Animation, Cyber Safety, Malayalam Computing, Electronics, Hardware, Development of Mobile Apps, Programming, Web TV, Video Documentation, Robotics, E-Commerce, and E-Governance (KITE, 2020).

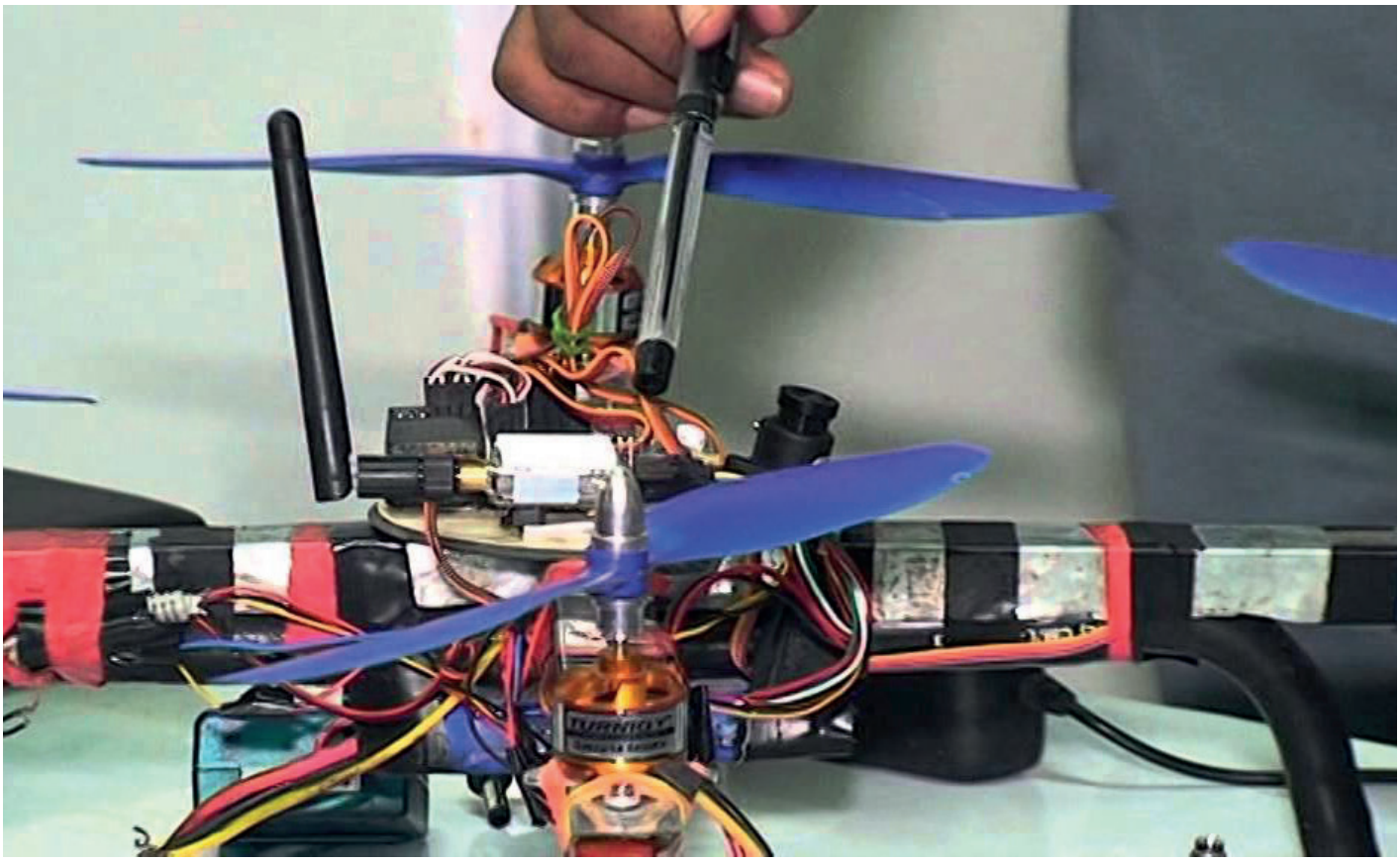
As part of Hi-Tech school project, KITE has also provided high speed broadband connectivity to 4,751 HS/HSS/VHSE schools in the State, except Tholpetty Govt High School in Wayanad District, due to extreme geographical constraints. KITE tries to make some alternative arrangements for getting internet connectivity in this school. KITE has partnered with Clean Kerala Company of Govt of Kerala to address the problem of eWaste, to dispose of over 1 Cr kilograms of eWaste from over 10,000 schools and the educational offices in Kerala. Till date about 741 Tonnes of eWaste has been disposed of from 14 districts. The equipments included in eWaste category are Laptops, Desktop Computers, Desktop Cabinets, CRT Monitors, Drives, Projectors, Printers, UPS, Television, Network Components, Camera, Speaker System, Generators etc (KITE, 2020).

For decades, KITE has been an ambassador for Free & Open Source Software, as it gives the freedom to create, edit and share educational content without any restrictions. The Operating System- developed by KITE- IT@School Ubuntu, is loaded with several educational applications. Several educational softwares like Dr. Geo, Rasmol, Chemtool, K-Tech lab, Geogebra, and Kalcium were

customised by KITE for developing teacher-friendly applications, which facilitates complete ICT enabled education in Kerala. Softwares like Dr. Geo and Geogebra are being used for teaching Mathematics. For teaching Chemistry, Rasmol, Chemtool and Calzium are used, whereas Geogebra, K-tech lab and PhET are used to teach Physics (KITE, 2020).

During 2017-18, The 'Little KITEs' programme was implemented. It aims to provide specific training on selected topics to the students and empower them to be the champions in their schools. The initial programme named 'Kuttikootam' has made a tremendous impact among the students, as it was later restructured . With the help of Little KITEs, specific trainings on diverse domains such as Animation, Hardware and Electronics, Development of Mobile Apps, Cyber Safety, Malayalam Computing, Programming, E-Governance, Video Documentation, Robotics, E-Commerce, and Webin TV are imparted to the students. At present, Little KITEs features 58,254 student

58,254
Little KITE students



members from 1,898 schools of Kerala and thus made it the largest Student IT Network in the Country (KITE, 2020). The Little KITEs system consists of KITE Master Trainers, Little KITE Masters, Mistresses and Little KITES members to coordinate activities like camps, workshops and symposiums at various levels (KITE, 2020).

KOOL- KITE's OPEN ONLINE LEARNING is an online tool to impart training courses to students, teachers, parents and public. School Wiki features the details of over 15,000 schools in Kerala and gives an outlook on the schools' elementary data, historical references, infrastructure, School websites, School Map, renowned Alumni, Class magazines, Blogs, supporting images and videos. The contents are in vernacular language and include contents developed by the students, teachers, alumni, and the public. It is a universal platform for collaborative learning for students. It aims at bringing out collaborative data building and to generate more interest among the students to learn Malayalam. It helps to generate more contents in various subjects (KITE, 2020).

The SAMPOORNA school management software is an effective monitoring and support system. It captures every minute detail of students in all schools. This software also includes additional details regarding teacher's data, administrative details, attendance etc. Sametham helps in sharing

Student Distribution by School Level

Percent of total (2019-2020)

See Table 1 in Appendix for further detail.

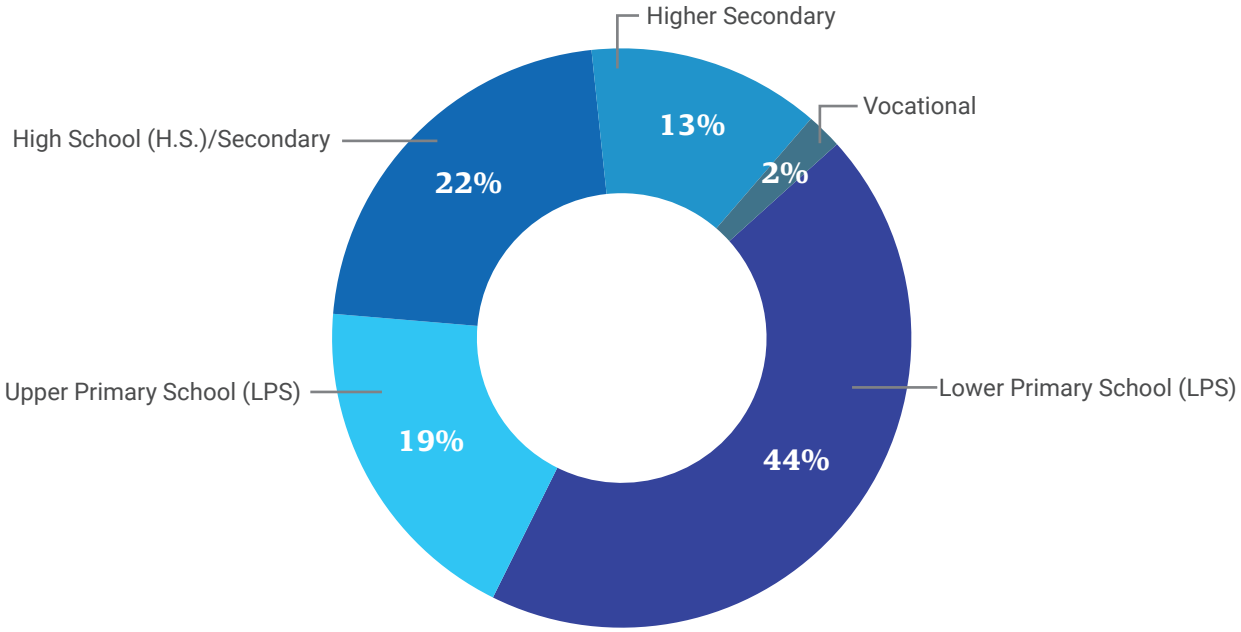


Figure 4. Student Distribution by School Level

SAMPOORNA

the authentic data of academic and infrastructure details of Govt, Aided and recognized Unaided schools in the state. It includes basic details of schools including their physical infrastructure, governing mechanisms, etc (KITE, 2020).

KITE is considered to be the world's largest simultaneous deployment of FOSS in Education. KITE is also recognised as the first SPV (Special Purpose Vehicle) Company of the Education Department of the State for implementing specific school projects. KITE is in a movement to extend its scope to the Higher Education sector including Arts & Science, Engineering colleges and Universities, to fuel ICT support in teaching and learning activities (KITE, 2020).

38%
govt. schools

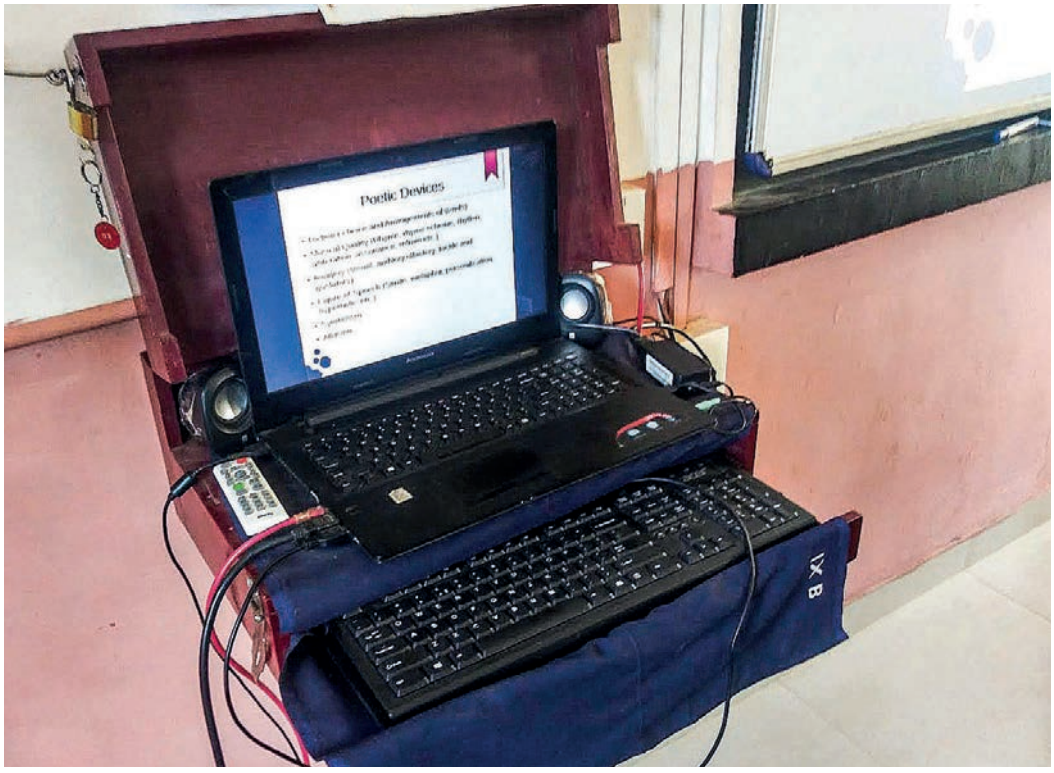
51%
aided schools

11%
unaided schools

EDUCATIONAL SYSTEM IN KERALA

The schools in Kerala are categorized by three funding models: the 'government' schools are funded by the government; 'aided' schools receive government funding for teachers' salaries but not for school infrastructure; and 'unaided' schools are funded solely by the private sector. Regardless of funding structure, all Kerala schools are affiliated to the Kerala State Education Board and follow the curriculum established by the state's General Education Department. All also receive institutional support from the State Council of Educational Research and Training (SCERT).

For the academic year 2019-2020, 16,028 schools, ranging from Lower Kindergarten to Twelfth Standard, followed the state syllabus. Of these, 38 percent were government schools, 51 percent were aided, and 11 percent were unaided (KITE, 2020). Figure 4 (and Table 1 in the Appendix) provides a detailed description of the student population in Kerala's educational system according to level, class, age, and total distribution.



BASELINE COMPARISON WITH OTHER INDIAN STATES AND UNION TERRITORIES

According to a recent report prepared by the Digital Education Division of the Ministry of Human Resources Development (India Report 2020), the Kerala Schools education system stands out as a leader in digital education in India. As the authors of the report note, 'Kerala has transformed public education through well-planned, interactive, community- supported, and globally competitive activities' (India Report 2020, p. 93). Indeed, with its well-equipped digital classrooms, ICT labs, online admission, e-content repository, e-books, offline books, interactive resources online, educational TV, educational radio channel, web TV channels, e-learning portal, computer-based learning, civil society partnerships, digital initiatives for competitive exams, and several other digital initiatives, the Kerala Schools education system lacked only those activities related to mobile applications (India Report 2020, p. 24).

Likewise, by 2016-17, only Kerala and Gujarat employed Computer Aided Learning (CAL) in more than 50 percent of their schools at the elementary level. Overall, Kerala stands fourth among the states of India in the number of secondary and senior secondary schools with computer facilities (NITI Ayog, 2019).

THE CONCERNS-BASED ADOPTION MODEL (CBAM)

The theoretical framework of this study is based on the three diagnostic dimensions of the Concerns-Based Adoption Model (CBAM). The dimensions are: Innovation Configuration, Stages of Concern (SoC), and Level of Use (LoU) (Hall & Hord, 1987, 2011). The SoC questionnaire (SoCQ) was used in the quantitative phase of the study to identify teachers' concerns, perceptions, feelings, and attitudes. The Innovation Configuration and LoU interview protocol were used in the qualitative phase of the study to explore how teachers use ICT in the classroom. The overall study was guided by the following research questions:

- Which areas of peak stages of concern (as described in the SoCQ) are most prevalent among teachers or facilitators in the use of ICT-enabled instruction?

- What patterns of behaviour are reflected among teachers in their level of use of ICT-enabled instruction?

One of the core tenets of this study is the premise that in any change process, personal connection is inevitable. This personal connection involves feelings and perceptions about the change, which can help or disturb the change process. For example, a person who is excited about a new technology will actively try to implement it, while a person who is sceptical of that technology will be less likely to embrace it and may even resist its implementation. According to Hall and Hord (2011), the sorted and classified feelings and perceptions are called 'concerns.'

These evolve into three major patterns or Stages of Concern (SoC): Self, Task, and Impact. Figure 5 illustrates the patterns in the stages of concern questionnaire (SoCQ).

As Hall and Hord (2011) note, "There is nothing inherently good or bad about a particular stage or pattern of concerns" (p.43). That is, one stage of concern is no better or worse than the other – concerns are not fixed in one stage. By selecting a number

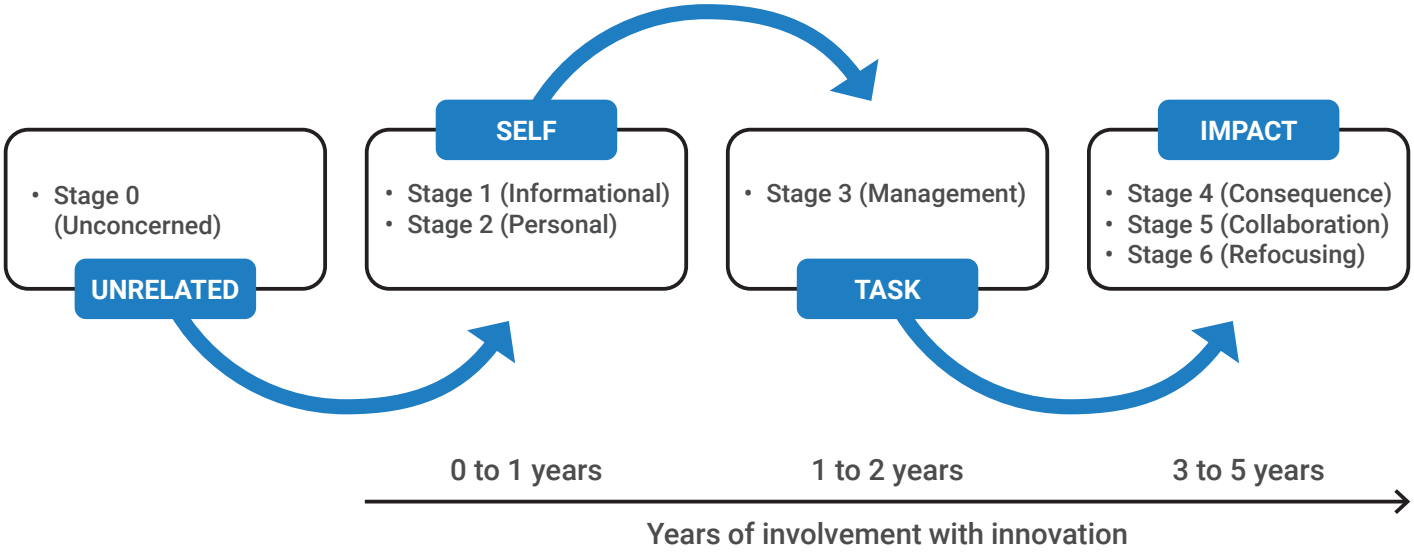
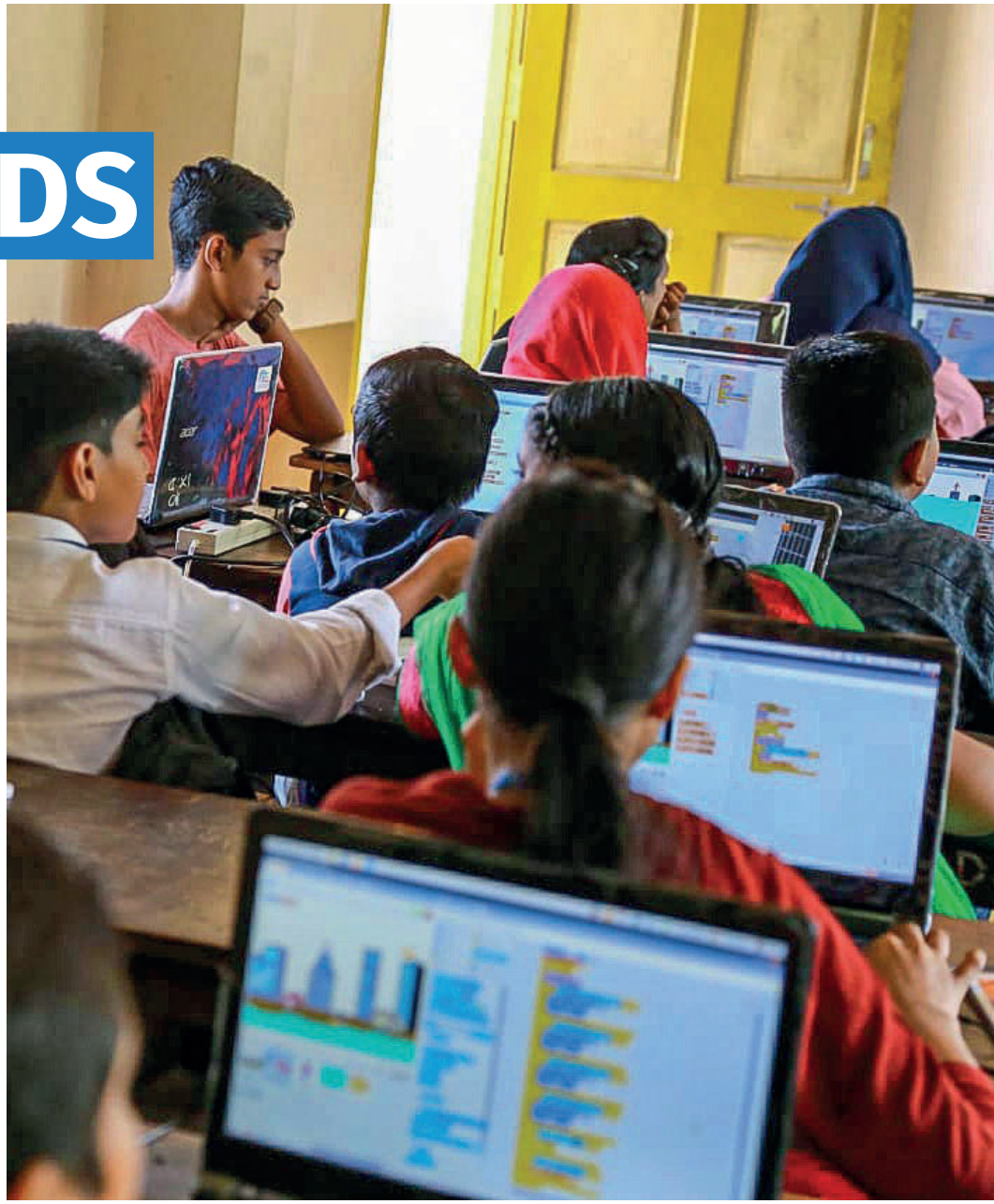


Figure 5. Patterns in the stages of concern questionnaire.

from a scale of zero to seven, teachers indicate the degree to which they have concerns about innovation; number seven indicates the highest level of concern, and zero indicates very little concern (George et al., 2006). In CBAM theory, if the media is appropriate and if leaders carefully facilitate the change process, then the frontline implementers (teachers) will move from Unrelated to Self- and Task-related concerns within a year. After three to five years, concerns related to the innovation should move to the Impact level.

METHODS



This study used a mixed-method approach, blending quantitative and qualitative methods. Figure 6 provides an overview of the research design, highlighting the key phases of the research process.

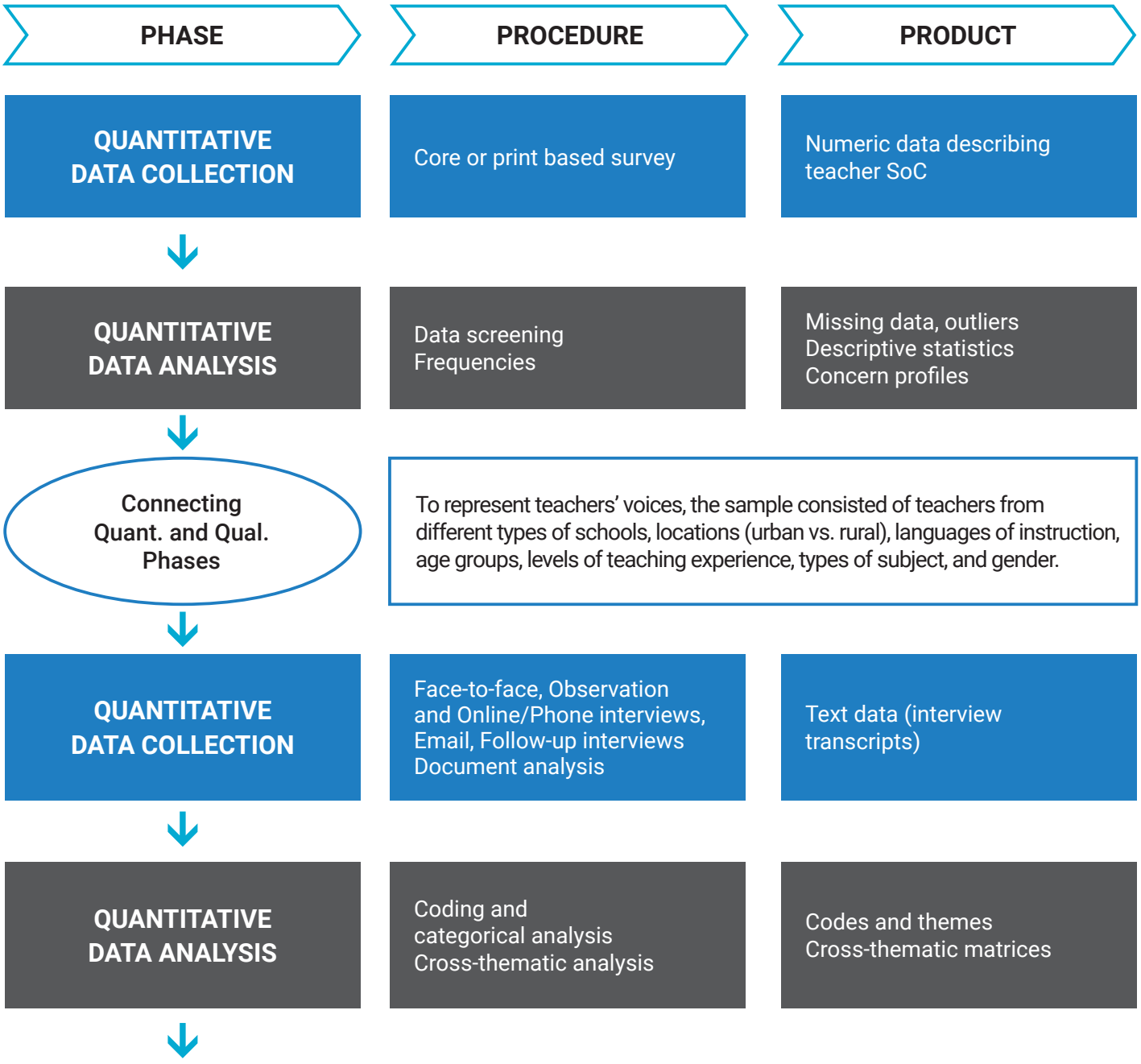


Figure 6. Research Design Overview and Key Phases.

Instrumentation

The questionnaire used in the present study has five sections: Welcome Letter, Adult Consent, ICT Access and Usage, Stages of Concern (SoC), and Demographic Questions. The 35 items and 8-point Likert-type SoC questionnaire are designed to assess the concerns of respondents during the implementation of an innovation. By selecting a number from a scale of zero to seven, teachers indicate the degree to which they have concerns toward innovation. Numbers six and seven indicate the highest level of concern, one and two indicate very low concern, and zero indicates that the issue is irrelevant (George et al., 2006). The term *innovation* in the questionnaire was changed to *ICT-enabled instruction*; this change was permitted by the original developers of the questionnaire.

Data Collection Procedures

Before the data collection, the researchers submitted the required Institutional Review Board (IRB) forms and were granted permission to conduct the study. With support from KITE, the principal investigator sent the survey, using a survey tool called Qualtrics https://qualtrics.ohio.edu, to teachers who had email addresses.

Population and Participants of the Study

The population of the present study was defined as high school (secondary) and higher secondary teachers employed under the General Education Department of the Government of Kerala, India who were involved with the ICT-enabled instruction.

Online Survey Response Rate

11,351
finished surveys

94%
completion rate

Using a systematic sampling frame, out of 4,752 schools, 1,188 schools were selected with a sampling interval of four. The online survey was distributed, on Feb 10, 2020, to schoolteachers who had an email address. Because of the low response rate even after three reminders, the research team decided to send the survey to the schools outside the sampling frame. The online survey was distributed again on April 1, 2020, and the survey was closed on April 10th. Out of 41,275 surveys sent, 12,118 teachers started the surveys and 11,351 finished the surveys for a 94 percent completion rate. More than 3,000 emails bounced, and there were several duplicate emails. The reasons for the low response rate might include issues with internet connectivity, power outages, and teachers' engagement with other seasonal activities (e.g., exams, student competitions).

Qualitative Data Collection

This phase of research consisted of school visits, classroom observations, and structured interviews with selected teachers and IT professionals. A total of ten schools (including urban, rural, public, and aided) and one regional resource centre were visited between February 26 and March 3, 2020. Photographs, video recordings, and concurrent fieldnotes were made during each of the classroom observations. More detailed notes were typed after each visit. Of the twenty-three recorded interview sessions with teachers, nineteen were conducted individually, and four were conducted in small groups ranging from two to ten participants. Additional interviews with ICT professionals were also recorded. The recorded interviews were later transcribed to enable thematic coding and analysis. Most of the interviews were in English. Where Malayalam, the regional language, was the language used, the transcript has been translated.

FINDINGS

Demographic Characteristics of the Online Survey Respondents

The following charts provide an overview of the findings we collected from the 11,351 teachers who completed our online survey. The first set of charts offers a picture of the respondents' demographic makeup, broken down according to gender, age, role (i.e., teacher, principal, support staff), medium of instruction, level of education, and area of academic specialization. The next set of charts provide baseline figures for reported ICT access and usage, both at home and on the job. The final set concerns the respondents' ICT use. Here we provide data showing how comfortable and confident teachers were with respect to using email, whether they have participated in ICT training sessions or made use of available resources for support, how they perceived the benefits of using ICT for teaching and learning, and finally, their overall 'Level of Use' for ICT in teaching and learning, according to the Stages of Concern questionnaire.

Teacher Demographics

See Table 2 in Appendix for further detail

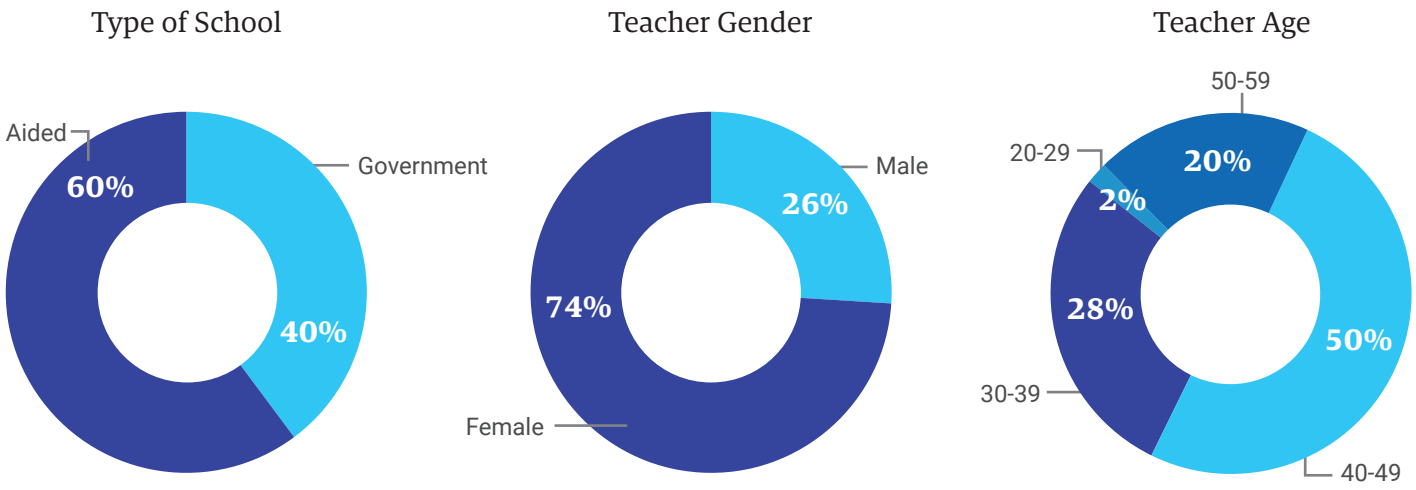


Figure 7. Teacher Demographics

	Frequency	Percentage
Primary Role		
High School Teacher	6243	65%
Higher Secondary	2470	26%
Primary School Teacher	357	3%
Principal	106	1%
Vice Principal	62	0.64%
Facilitator (Technology coordinator etc....)	55	0.57%
Head of the Department	22	0.25%
Other	274	2.85%
Medium of Instruction		
Malayalam	4830	50%
English	4024	42%
Both (English & Malayalam)	421	4%
Other	360	4%
Teaching Certification		
Master of Education (MEd)	487	6%
Bachelor of Education (BEd)	7484	78%
Other	1598	16%
Education Status		
Post Graduate Degree	6493	67%
Bachelor Degree	2563	26%
Doctoral Degree	109	1%
Other	464	6%
Content Area		
Science	3219	52%
Arts	2420	39%
Commerce/Management	465	7%
Others	101	2%

Table 2.
Demographic Details

ICT Access and Usage – Online Survey Respondents

See Table 3 in Appendix for further detail

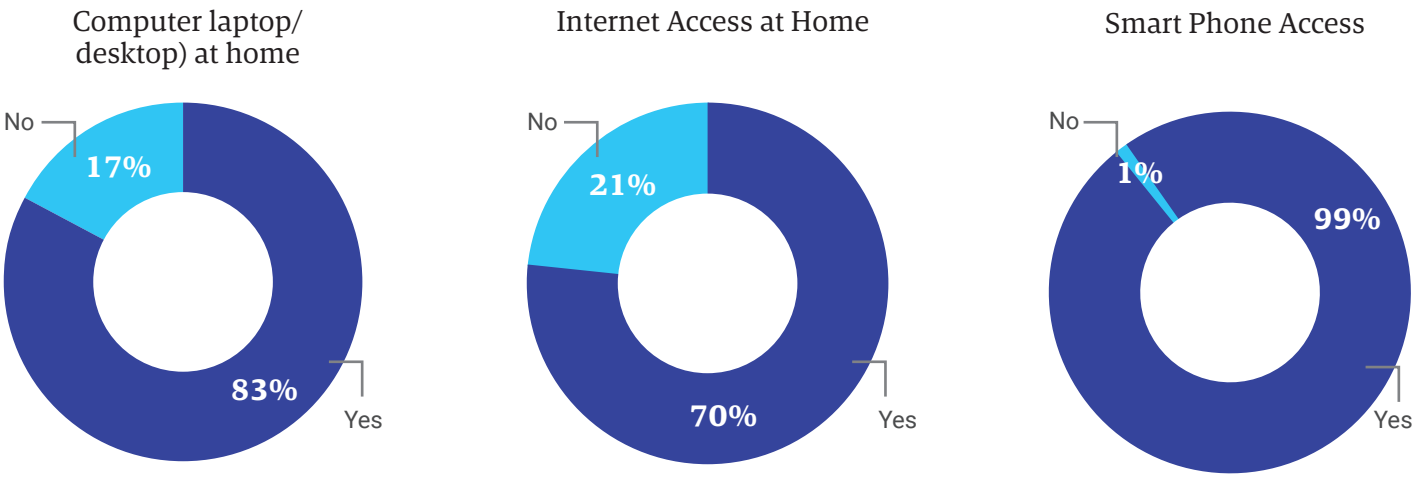


Figure 8. ICT Access and Usage

Computer Access at Home Among Male and Female Teachers

See Table 4 in Appendix for further detail

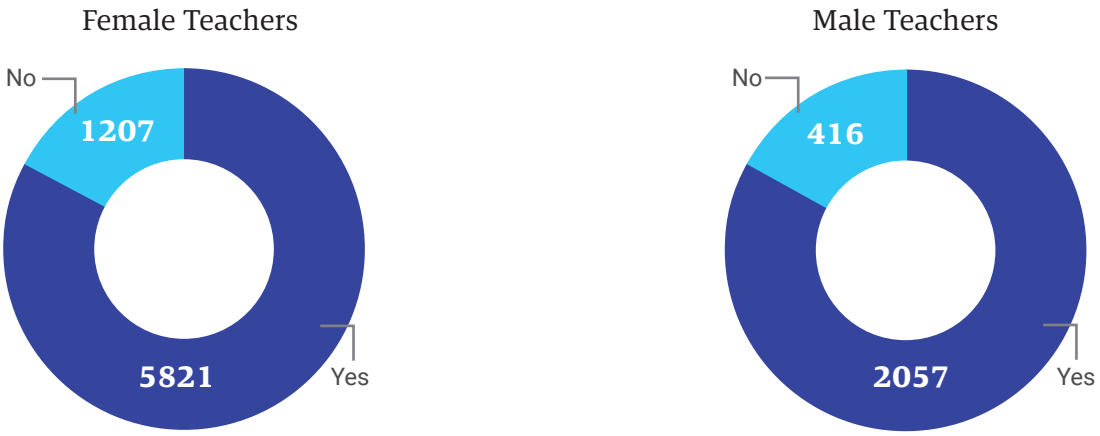


Figure 9. Computer Access at Home

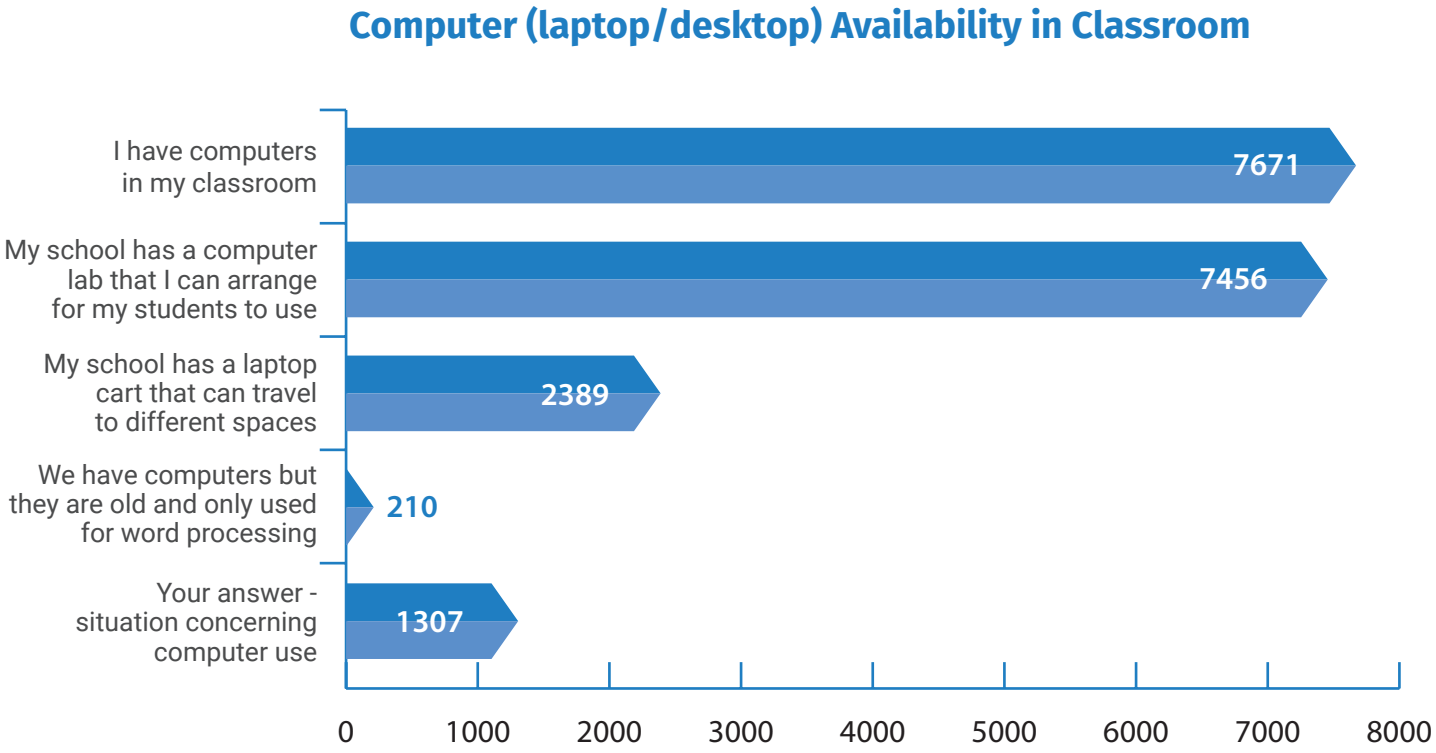


Figure 10.
Computer availability in classroom. It is represented in Table 5.

99%

Have computers available in their educational institutions

Technologies Available in Educational Institutions

See Table 6 in Appendix for further detail

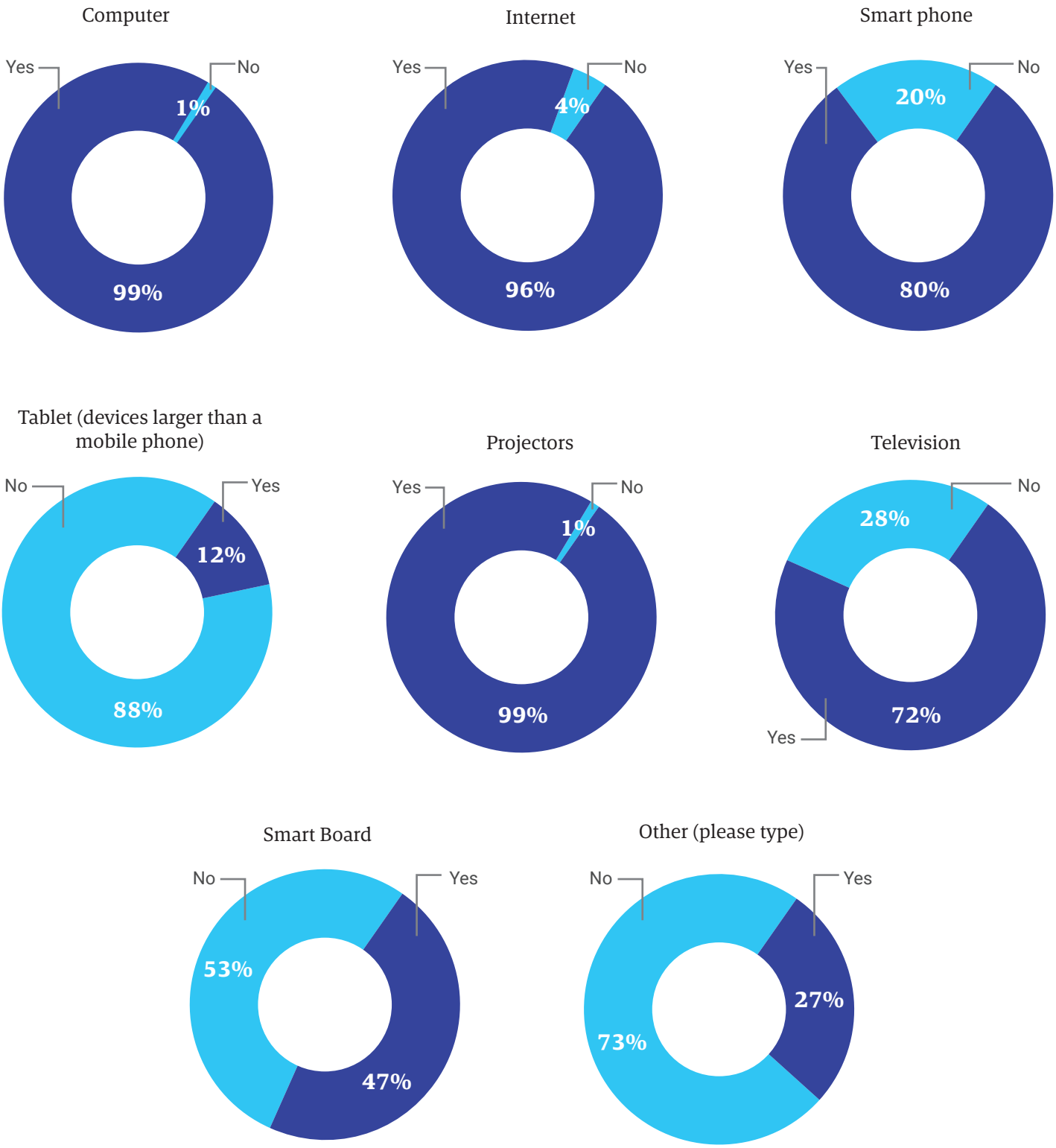


Figure 11. Other Technologies for Teaching

The other technologies used in teaching are represented in Figure 7.

Other Technologies for Teaching

59.48%
Computer usage in the classroom

60.84%
Internet usage in the classroom

Figure 12. Other Technologies for Teaching

Figure 13 shows the type of technology used in the classroom

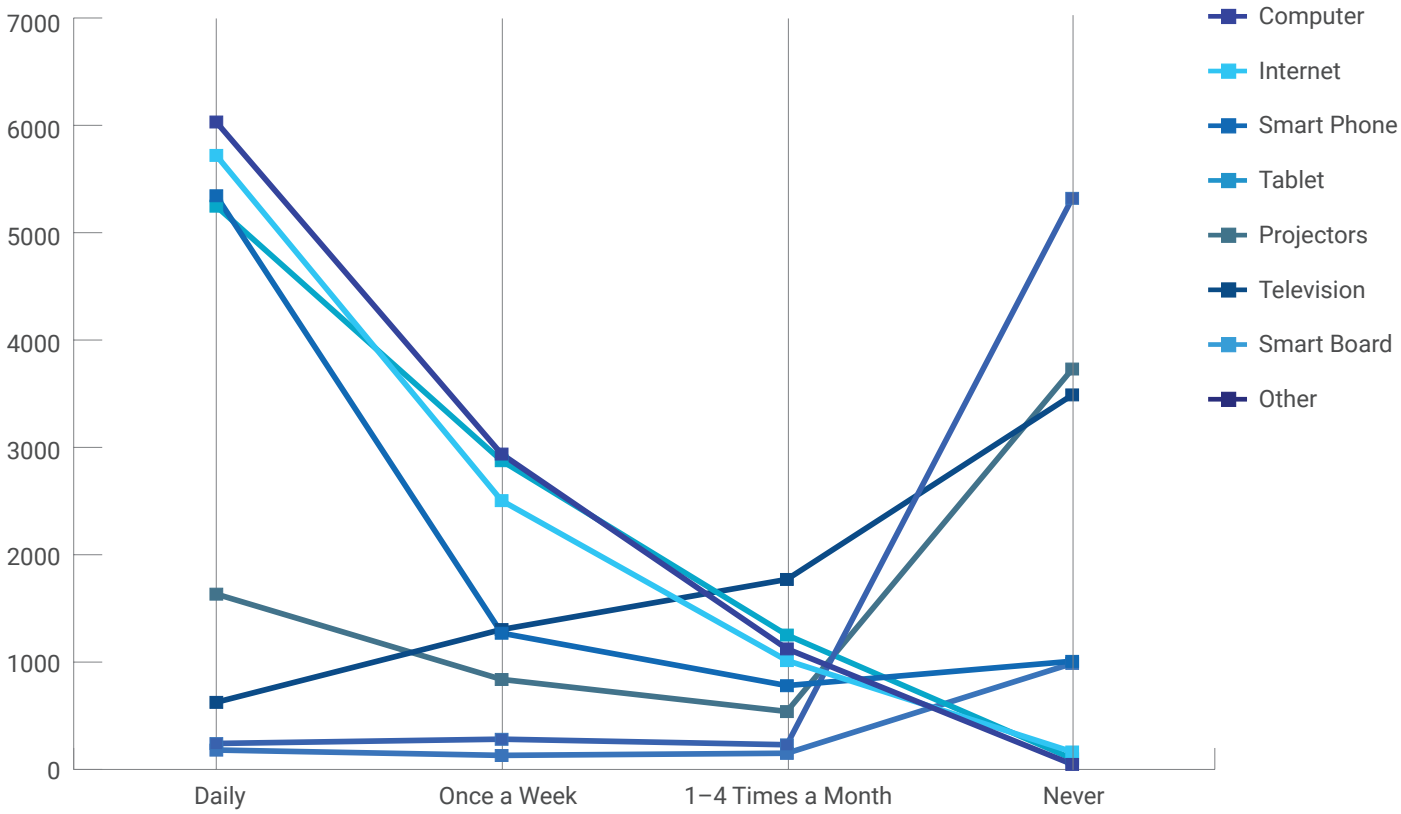


Figure 13. Technologies Available for Teaching

Levels of Use of ICT-enabled Instruction

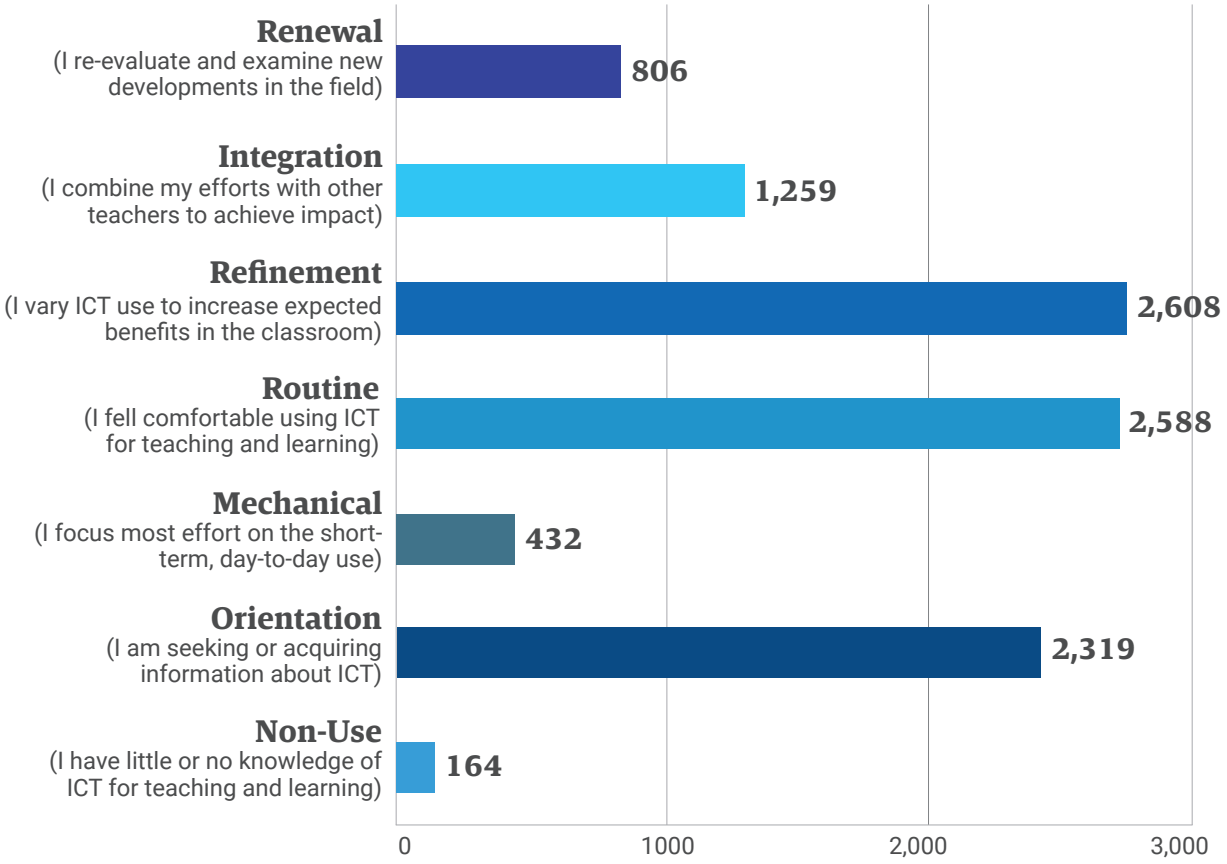


Figure 14. Patterns of behaviour are reflected among teachers in their Level of Use of ICT-enabled instruction

9571

Confidence/comfort in using email

95.26%

Yes

See Table 8 in Appendix for further detail

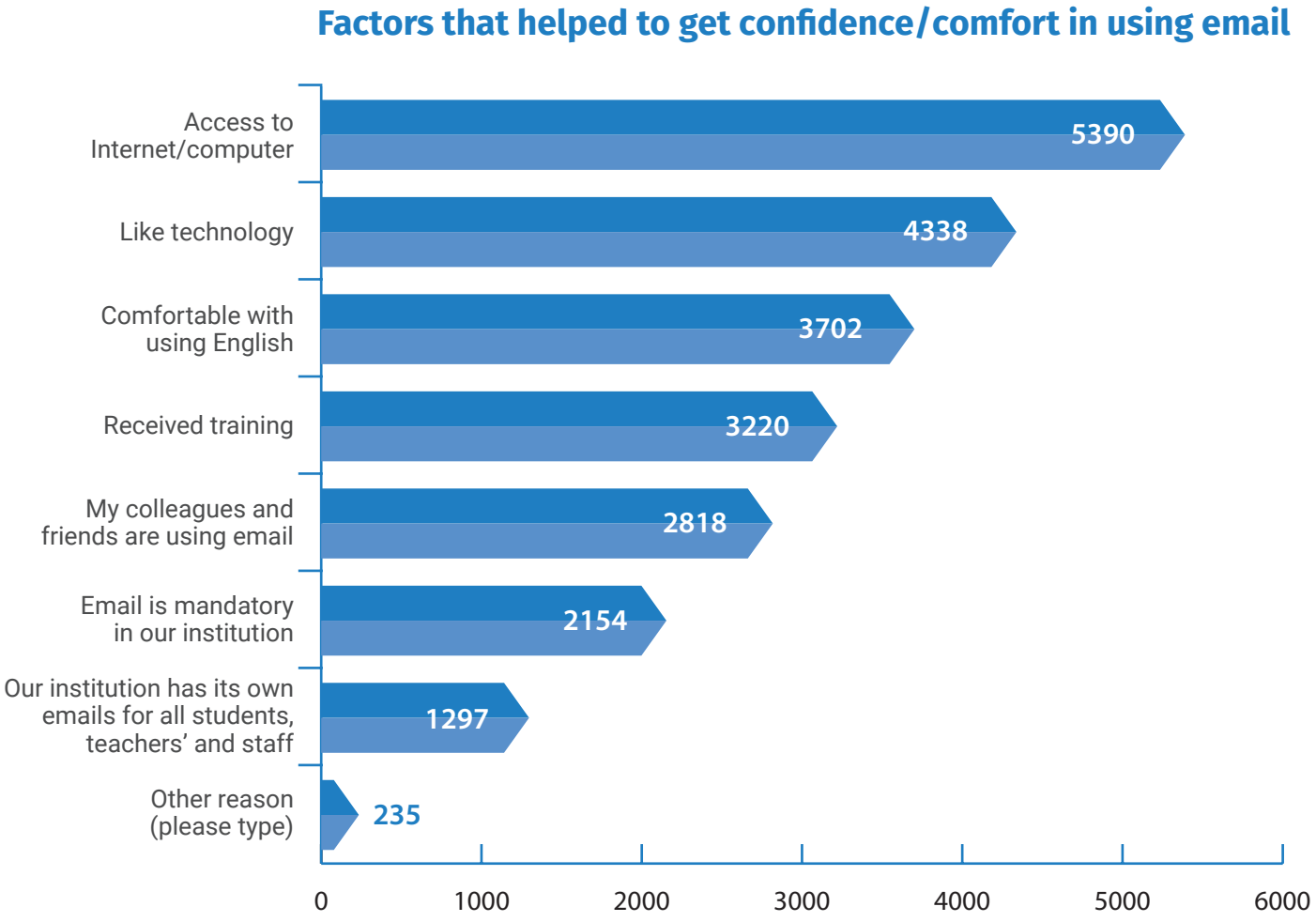


Figure 15. Factors help to get comfort in using Email

5390

access to internet/ computer

4338

like technology

Training received to use ICT to support teaching and learning

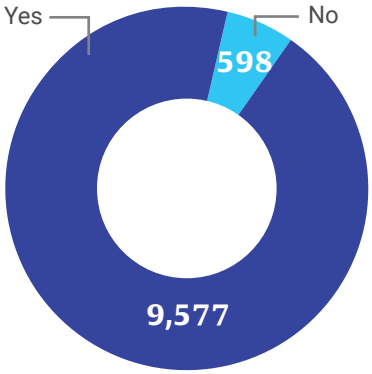


Figure 16. Training received to use ICT

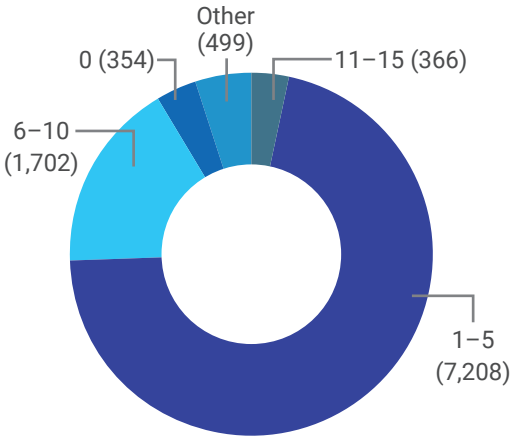


Figure 17. Number of ICT trainings participated In

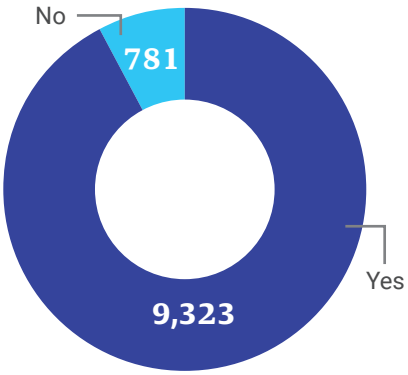


Figure 18. Use of technology to support or supplement teaching

Technology resources used most often to support or supplement teaching

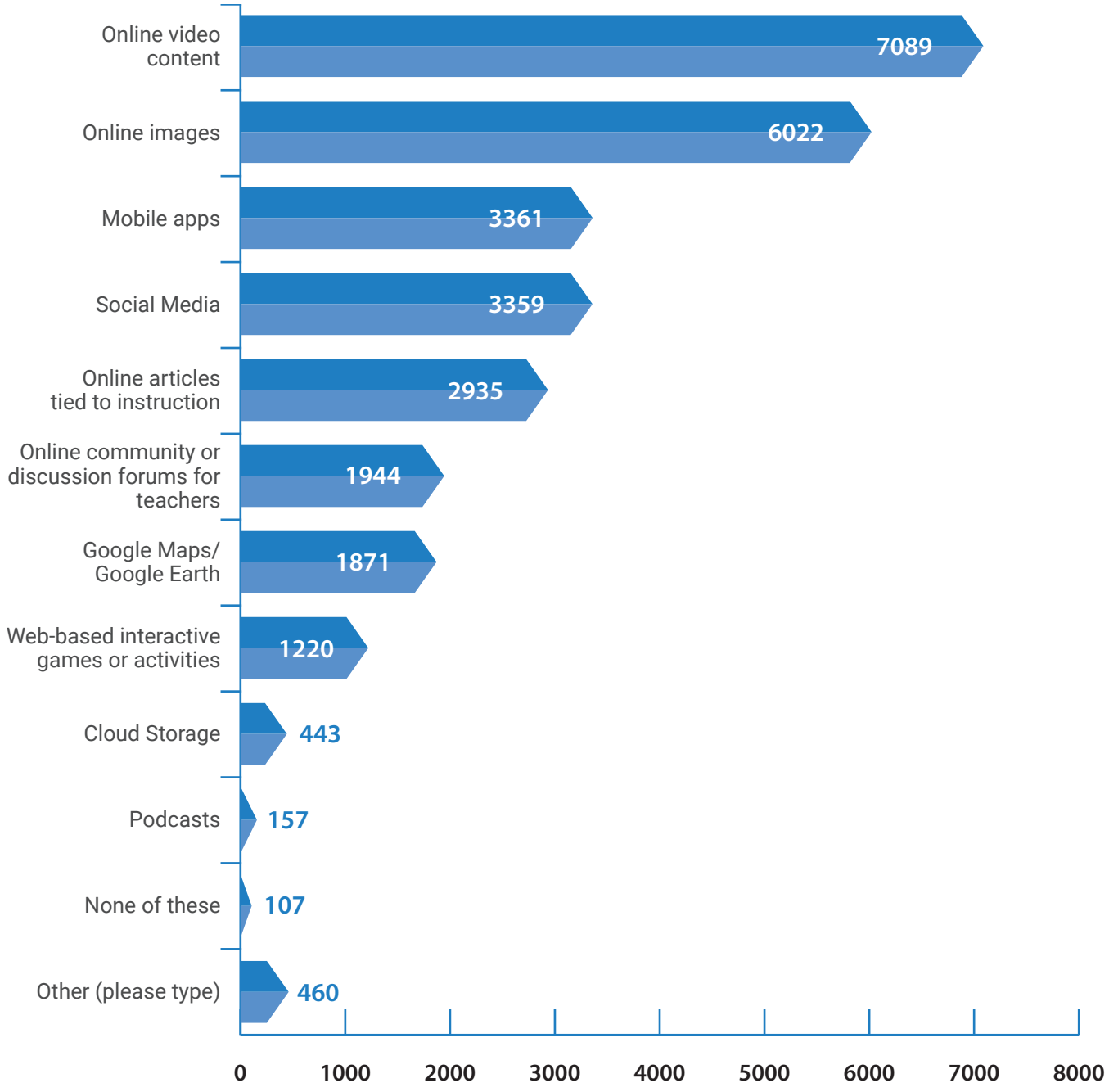


Figure 19. Use of technology to support or supplement teaching

7089
online video content

6022
online images

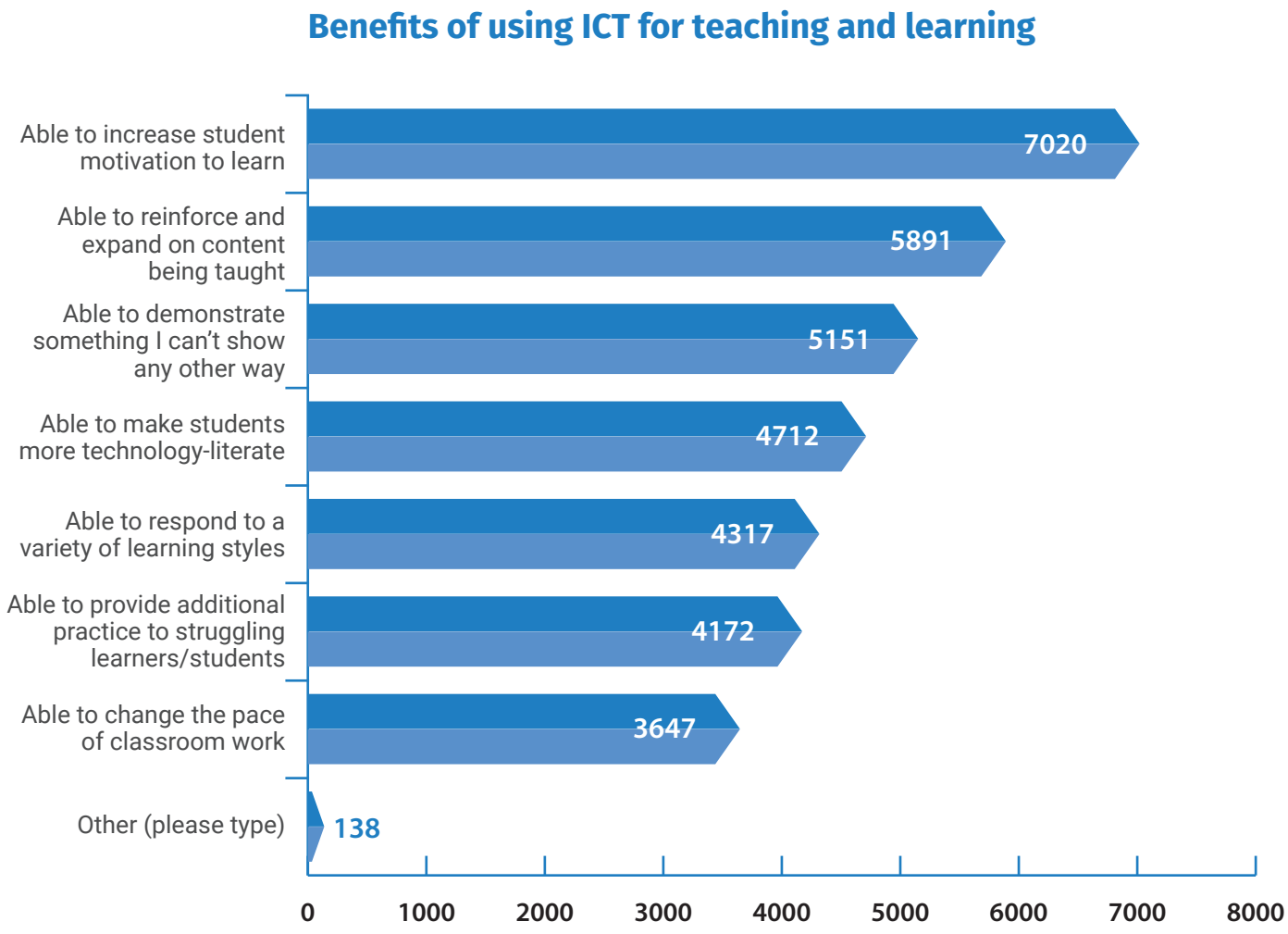


Figure 20. Benefits of using ICT for teaching and learning

7020

able to increase student motivation to learn

5891

able to reinforce and expand on content being taught

STAGES OF CONCERN

Stage of Concern	Typical Statement
0 Unconcerned	"I think I heard something about it, but I'm too busy right now with other priorities to be concerned about it."
1 Informational	"This seems interesting, and I would like to know more about it."
2 Personal	"I'm concerned about the changes I'll need to make in my routines."
3 Management	"I'm concerned about how much time it takes to get ready to teach with this new approach."
4 Consequence	"How will this new approach affect my students?"
5 Collaboration	"I'm looking forward to sharing some ideas about it with other teachers."
6 Refocusing	"I have some ideas about something that would work even better."

Figure 21. Seven Stages of Concern

Background on the Seven Stages of Concern

The Stages of Concern model consists of and describes seven categories of possible concerns related to an innovation. People who are in the earlier stages of a change process will likely have more self-focused concerns, such as worries about whether they can learn a new program or how it will affect their job performance. As individuals become more comfortable with and skilled in using an innovation, their concerns shift to focus on broader impacts, such as how the initiative will affect their students or their working relationships with colleagues.

Source: https://sedl.org/cbam/stages_of_concern.html

A 35-part questionnaire was used to assess the concerns of teachers during implementation of ICT-enabled instruction. By selecting a number on a scale of 0-7, teachers indicate the degree to which they have concerns regarding ICT.

concerns reported were stage 2 and stage 3 concerns. Stage 2 concerns are personal — the teacher wonders how the new changes will impact their own routines and their personal protocols. Stage 3 concerns, on the other hand, are managerial, related to time, logistics and the coordination of ICT-enabled instruction.

What follows are interventions strategies that are designed to address Stage 2 and 3 concerns.

Intervention Strategies to Address Stage 2 (Personal) Concerns

Supportive Discussion • Patient Implementation • Realistic Goal Setting • Enable through Training

Stage 2 (Personal) concerns indicate that teachers perceive the implementation of ICT-enabled instruction as something that will have an impact on their own routines and protocols. Teachers who have a high personal concern show a discomfort or lack of confidence in using ICT-enabled instruction.

Change facilitators can address the Stage 2 (Personal) concerns by implementing the following interventional strategies —

1. Supportive discussion. Through personal conversation, colleagues and trainers can build rapport and encouragement. Colleague assistance is a key factor in the diffusion and implementation of new technology systems.
2. Patient implementation. If teachers are not comfortable with ICT, change facilitators can initially give more time to teachers without pushing them to use ICT-enabled instruction. This report recommends creating a non-punitive environment where teachers can experiment with technology.
3. Realistic goal-setting. Set small goals or expectations about the

use of ICT-enabled instruction instead of expecting immediate major leaps in the use of the technology.

4. Enable through training. Provide personal support and easy access to trainers and support staff (Hall, 1979). Allow more in-service training and release time to enable teachers to become experts in ICT-enabled instruction. Release time has been shown to make a significant difference in teachers' attitudes towards technology.

Conclusion — It is the responsibility of all who support teachers in the implementation of new technologies to take these Stage 2 personal concerns seriously and to help create a supportive environment in which the teacher can make use of the expertise of colleagues, can start small, can set realistic goals, and can receive any additional training they require to become experts and advocates of ICT-enabled instruction

Intervention Strategies to Address Stage 3 (Management) Concerns

Make Use of Experience • Provide Resources for At-Home Practice • Ongoing Support • Set a Schedule

Teachers who have Stage 3 (Management) concerns have issues with time, logistics and the coordination of ICT-enabled instruction. Usually inexperienced users who are adopting new technologies for the first time will have more management concerns.

Change facilitators can address the Stage 3 (Management) concerns by implementing the following interventional strategies:

1. Make Use of Experience. Provide after-school advice and assistance sessions with experienced teachers who use ICT in the classroom.
2. Provide Resources for At-Home Practice. Establish a lending program in which teachers can check out ICT-tools from the

school and use them at home, which gives the teacher an opportunity to practice. This will reduce their fear of technology and increase access. (See Page 31 for percent of respondents with internet access at home).

3. Offer Tutorials. Create a pool of "how-to" tutorials to answer small and specific questions about the management of ICT- enabled instruction. These "how-to" tutorials can be posted on the school website, YouTube, printed in a handbook, and copied onto USB flash drives.
4. Highlight Relevance for Daily Life. Show how various types of ICT (e.g., mobile phones) have already been integrated into multiple aspects of teachers' day-to-day activities. This will help teachers to perceive ICT as part of their daily activities.
5. Communicate. Create a platform where teachers can share their successful and unsuccessful stories about ICT-enabled instruction.
6. Set a Schedule. Select and plan for one specific ICT-enabled instruction task for each week, then offer teachers feedback for improvement. Then work to create a larger timeline that allows teachers to be trained for specific tasks, one by one. The more specific the new task, the more likely it is to be implemented over time. (Hall, 1979)
7. Support Groups. Establish support groups among teachers with experienced and inexperienced teachers.

Conclusion — Many of the management-level concerns that teachers have towards the implementation of ICT programs can be addressed through proper training, scheduling, ongoing tutorials, and peer involvement. These ongoing systems of support must be part of the framework of any ICT program.

Analysis of Open-ended Concern Statements

Teacher concerns were also assessed through an open-ended concern statement which was included with the 35-part survey. The question was:

When you think about ICT to support teaching and learning, what are you concerned about? What problems (if any) have you had in using ICT as part of teaching/facilitating? (Please write in complete sentences, and please be frank)

- *My First Concern*
- *My Second Concern*
- *My Third Concern*

Out of 11,351 teachers who completed the survey, 7,187 teachers responded voicing at least one concern.

Table 9 shows the frequency of concern statements.

Time	1266
Internet/Network	654
Power/Electricity	506
Training	242
Equipment	50

Level of Use – Qualitative Data

A significant part of the work to assess the feedback and concerns of teachers implementing ICT in the classroom included qualitative interviews in which teachers could speak freely about the successes and challenges they've faced.

The goals of collecting observational and interview data were (1) to gather information on how technology was being used in the classrooms; and (2) to assess the teachers' perceptions of the effectiveness of the current KITE program on a qualitative level. Of the ten classes that were observed, all were equipped with an internet connection, a dedicated laptop, and an overhead projector. ICT-enabled teaching featured prominently in the classroom activities.

The structured interview questions probed the teachers' perception of the strengths, challenges, and effects of using ICT. Teachers were also asked to identify areas needing improvement.

The qualitative teacher feedback was overwhelmingly positive and highlighted many of the strengths of using ICT in the classroom. Teacher responses often contained words such as 'easy', 'effective', 'interesting' and 'useful'. Teachers described ICT in the classroom as an effective way for students to learn, saying that it holds interest and offers students alternative ways of learning and receiving information that can be helpful when they are accustomed to only one teacher. Teachers also noticed a pronounced increase in student participation. They reported that the use of multimedia and visual learning tools helped the students retain knowledge better, and was valuable across multiple subjects of study. It was also remarked that the program is particularly effective for students who face learning challenges or who are differently abled. It is clear from these qualitative responses that the teachers saw the benefits of using ICT both for themselves and for their students.

When asked about the challenges of using ICT for teaching and learning, the teachers almost always pointed to issues with infrastructure and equipment rather than any intrinsic limitations of the new modality. The needs they identified can be addressed by making sure equipment is up to date, internet connections are strong, and textbooks are available electronically. Programs should provide opportunities for technical and professional development, implement green solutions for e-waste, and set up an online system for examinations.

The following section of the report provides a representative sample of verbatim responses we collected from teachers. The responses included here are from the interview transcripts with higher secondary teachers in a wide range of subjects, including Art, Languages and Literature (English, Hindi, Malayalam), Natural Sciences (Biology, Chemistry, Physics) and Social Sciences (History, Geography).

ICT implementation in the classroom

- Holds student interest
- Greater knowledge retention
- Visual and multimedia tools add variety to learning experience
- Measurable student improvement across all subjects
- Powerful tool for language instruction and spelling
- Empowers students as problem-solvers
- Increases student participation and activity

Teachers' Responses

Strengths

"I'm using high tech very effectively and [the] children are very interested. I find it very easy to teach and convey the message to the children... I know how to type in Hindi, so I prepare almost all the things by myself. I prepare for myself and sometimes I download from the net or we also have the Samagra portal. So, I use all those things and [especially for] those children who are a little bit backward, it is very much useful. And they also will be very much interested. They can sing and dance. For language teaching, it's very useful."

"These are audio visual treats for the students. So instead of listening to our lectures and being bored, they can learn History and all about old things. Otherwise they may not be interested. They may go to sleep. But now when you teach revolution or things like the volcanic eruptions and all that it will be so interesting for them. They will be alert. They will watch and they will never forget what they learn. They are very much interested. And it's easy for us to explain. We need not explain much. It's very clear to them. They find learning enjoyable. They get practical knowledge. They can see for real what is happening. So, they understand, especially the problem, and if we show them, they understand the topics, methods, you know, they understand the technique... Yes, we get very active participation from the children."

"If I am making a flower, I show how to make the flower on the internet. So, it's very easy. I need not show and go to each student and teach them, but enough to show on the computer. It's very easy for them. They can refer at home also. So, it's very useful. When they see the things, it will be clear for them and it will be imprinted in their minds. It won't go very fast. They won't forget it. When we hear something, there is a possibility to forget the things. But when we see things, it is imprinted in our minds. So whatever we teach with this technology, that will be a great help to the children, especially for the weaker students, it is a great help and they will learn very fast, faster than what we speak, what we see."

"In the case of English, they know the spellings clearly. They go through the spellings and they've got enough vocabulary. They can read and we can show the special activities for them, I can do it and they can clearly check it out themselves. They can clear the doubts. If they make mistakes, they can redo the activities and they can check it out. It is very easy to convey. Some students are inactive in the classroom. But they are interested to watch the videos."

"I find it very effective for children, using high-tech equipment. Even if they are not mingling in the classroom, they are interested in watching the videos. Especially when teaching the function of the heart, working of the kidney, they can understand easily. It is easy for teachers also."

"They can study all the lessons, but they never get those pictures."

"I find it [the use of ICT] very interesting . Seeing or visualizing the concept or some experiments or demonstration etc. They are getting a quality education. It enhances or increases the learning outcome of the students, output of students."

"Children who are challenged or students with learning disabilities, those students also find it useful. We have a visually challenged girl. I make the student listen because she can hear properly, and she tells me whatever she has learned. So, she can go home and prepare. That way it's very useful."

"Samagra provides us with so many resources, but other than that, we add extra. Whoever wants can do it. And you can add your own and facilitate the children or you can make the student prepare and then show them. We can add to what the government and the education department has provided."

Challenges

"If electricity fails, with power failure, net connection is disturbed, the system may be out of order, in such case, what we prepared can't be done. And it will take more time also. If electricity fails, what we prepared can't be done in the classroom."

"We, the teachers, are eager to have more training on hardware-related matters, so that minor issues in hardware can be resolved at our end. "

"In Kerala, the portion (curriculum to be taught) is vast, so the teachers find it very difficult to manage the portion within time. It is not practical to take all classes in this way. For all subjects it is time consuming. We must take extra classes and still we won't finish because we have such a vast portion."

Effects

"We can develop whatever attitude we want to develop, good attitudes, the aims of the lesson. When we give them an assignment, they have their choice, they can collaborate with each other. Then, they can communicate, then work deeply. I think their creativity can be developed. All this is possible."

"When the scaffolding questions are asked, we show a video or audio and we ask questions and interact with the children. Then, if we take a play, then the children, we divide them into groups, and they prepare their own script and they show the play in the class. In such a way we are evaluating. And all the group members should participate in that. Each and every member will participate."

"They are very much interested to see the videos. They ask to repeat them. Suppose we are teaching a poem, when I sing and make them sing, watching the video and listening to it for fifteen minutes, they pick up very fast. And instead of teaching them or giving a lecture, if we show the video, they pick up very fast. They are very much interested, and they never forget. But if I make them learn something which I am telling them to pick up from me, they will forget very fast. But this they will never forget. Language, it is becoming very easy to teach. But there are a lot of portions, that is a difficult thing. I must take a lot of extra classes, evening classes, morning classes, in order to finish the portions. But it is effective. Especially for the weaker students, it is very nice. Very good. Useful. We are using Samagra. Samagra has so many resources. For languages, there are so many. Nice poems with nice tunes they have introduced in the Samagra portal. For language, they have so much. For Hindi, Malayalam and English. There are recitations. And when we use them, the children are very much interested. All will be fully immersed in that. It is very good. They are also seeing the visuals. Seeing and listening, we give 99% to the children. I also prepare for myself. As I told you earlier, I know how to type in Hindi. I prepare each lesson myself and save it on the USB to show the children. Both using Samagra as well as what I have prepared myself. And I also ask the children to contribute their part and they are very much interested."

"Children are equipped to open the computer and find the Samagra based things and find out what is in them."

Needs

"The children must carry all their textbooks to the schools. Instead, only one laptop with all the textbooks is needed to reduce the burden. All textbooks must be made available in one laptop."

"I am not completely using [ICT]. To really give everything needed I must improve. We need to update ourselves. We are trying to. We need to get more information to become more efficient. We are not experts in technology. We want more training."

"We must deal with e-waste. Physical structure of the classroom is not suitable. When we teach in one class using high tech equipment, the sound disturbs the nearby classes."

"Examination should be made online."

CONCLUDING DISCUSSION AND RECOMMENDATIONS

The goal of this study was to measure the implementation of ICT in Kerala schools by measuring teachers' level of use and identifying teachers' concerns. By sharing the outcomes of this report, programs such as KITE can serve as a scalable and implementable example for neighboring states and so that ICT programs can function more effectively within Kerala schools. To understand the effectiveness of the program, we sought to gain a clearer picture of the concerns of the teachers who are on the ground making this ICT-enabled teaching and learning a reality.

In comparison to a previous study with KITE teachers conducted by one of the authors (Thankachan 2012), the online survey response in 2020 showed a significant increase in email use among teachers. Indeed, only 226 teachers completed the 2012 survey, which was distributed to 34,950 teachers who had email addresses. In the present study the online survey was distributed to 41,275 teachers, with 11,351 completing it. This alone shows a strong indication of the effectiveness of the frequent training programs and other opportunities teachers received between 2012 and 2020.

The overall response from survey, interview, and observation was that Kerala teachers and students alike have benefitted immensely from the recent changes and state-wide initiatives such as KITE that have brought ICT to their schools. With new technologies and platforms, the teachers can work more effectively and more efficiently while students are more interested and are learning more and performing better.

A significant portion of survey respondents indicated that through the implementation of ICT programs they are able to:

- increase student motivation to learn,
- reinforce and expand on content being taught,
- demonstrate something they can't show any other way,
- make students more technology-literate,
- respond to a variety of learning styles,
- provide additional practice for struggling learners/students, and

- change the pace of classroom work.

Qualitative teacher feedback was also overwhelmingly positive and highlighted many of the strengths of using ICT in the classroom. Teacher responses often contained words such as 'easy', 'effective', 'interesting' and 'useful'. Teachers described ICT in the classroom as an effective way to learn, saying that it holds student interest. Teachers also notice a pronounced increase in student participation.

When asked to identify areas in which ICT-enabled teaching and learning could be improved, respondents pointed to infrastructure problems. Among these, power failure and loss of internet connection were the most frequently cited concerns.

Despite the prevalence of infrastructure problems, it is worth noting the significant improvements that KITE has made through technology interventions and upgrades to the physical infrastructure of schools throughout the state since 2017. In July 2016, for instance, classroom observation and interviews with teachers and students at SMV Model HSS and St. Joseph's HSS in Thiruvananthapuram and St. John's and Girls Government HSS in Mavelikara revealed that each school was equipped with only one smart classroom. With their former dependence on shared facilities, ICT-enabled teaching and learning was not possible as a regular and recurring feature at these schools but was reserved for special times and for a limited number of students.

Returning to the 2020 study, in which all the classrooms we observed were equipped with a working internet connection, a dedicated laptop, and an overhead projector, teachers connected the specific limitations imposed by power cuts and intermittent loss of internet connection with the broader problem of time management that also emerged as the top concern in

the survey data. Because of the prevalence of power cuts, the teachers have adopted formal and informal innovations – from keeping a traditional back up lesson plan to saving material on USB pen drives and using their own phones to create a mobile hotspot. But these practices take up valuable time. In the long run, therefore, the infrastructure problems need to be addressed.

Recommendations

Based on all the information gathered over the course of this study, we have summarised the following recommendations:

- Continue to implement ICT programs across Kerala schools
- Openly provide information to neighboring states on the effectiveness and success of the program, key learnings, and best practices
- Continue to monitor teacher concerns and provide support, including —
  - Ongoing Training & Tutorship — ICT Training programmes should be tailored and implemented to in-service teachers to keep them updated with the changes in the technologies used for teaching.
  - Online certificate courses on ICT-enabled education for teachers
  - Pre-service teachers should be equipped with concrete ICT skills before certification. This will help them to use the ICT best practices during their teaching learning process.
  - Formalized colleague assistance programs and regular team discussions
  - Technology lending programs
  - Ongoing discussion and evaluation — keep feedback loop open and responsive
- Address infrastructure and technical concerns through the following steps —
  - Combine the ICT expertise of KITE with a new Green Energy platform that would use solar power to obviate the problem of the power cuts and related time loss.
- Equip each school with a dedicated server location (a lean/content server) linked to a solar powered battery. Each school could then keep current content from Samagra on the local server rather than stored on the cloud. This would allow the content to be updated at intervals without the schools being constantly dependent on internet access.

We were fortunate to have completed the data collection phase of this research just ahead of the COVID-19 related lockdowns, travel restrictions, and general discontinuation of research involving physical contact with human subjects. Though this was not part of our initial research design, the flexibility made possible by the integration of ICTs into teaching and learning in Kerala schools now stands out as a major if unintended benefit during the present health crisis.

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APPENDIX

Table 1. Educational System in Kerala according to Level, Class, Age, and Total Distribution

Levels	Grades/Class	Age in years	Percent of Total (2019-20)
Lower Primary School (LPS)	1-4	5-8	44%
Upper Primary School (UPS)	5-7	9-11	19%
High School (H.S.)/Secondary	8-10	12-14	22%
Higher Secondary	11-12	15-17	13%
Vocational	11-12	15-17	2%

Table 2. Demographic Details

	Frequency	Percentage
Gender		
Male	2500	26%
Female	7121	74%
Type of School		
Government	3807	40%
Aided	5755	60%
Age Group		
20-29	181	2%
30-39	2711	28%
40-49	4802	50%
50-59	1851	20%
Education Status		
Post Graduate Degree	6493	67%
Bachelor Degree	2563	26%
Doctoral Degree	109	1%
Other	464	6%

Table 2. Demographic Details

	Frequency	Percentage
Primary Role		
High School Teacher	6243	65%
Higher Secondary	2470	26%
Primary School Teacher	357	3%
Principal	106	1%
Vice Principal	62	0.64%
Facilitator (Technology coordinator etc.…)	55	0.57%
Head of the Department	22	0.25%
Other	274	2.85%
Medium of Instruction		
Malayalam	4830	50%
English	4024	42%
Both (English & Malayalam)	421	4%
Other	360	4%
Teaching Certification		
Master of Education (MEd)	487	6%
Bachelor of Education (BEd)	7484	78%
Other	1598	16%
Education Status		
Post Graduate Degree	6493	67%
Bachelor Degree	2563	26%
Doctoral Degree	109	1%
Other	464	6%
Content Area		
Science	3219	52%
Arts	2420	39%
Commerce/Management	465	7%
Others	101	2%

Table 3. ICT Access and Usage: Online Survey Respondents

	Yes		No	
	Percentage	Count	Percentage	Count
Computer (laptop/ desktop) at home	83%	8491	17%	1769
Internet Access at Home	70%	8107	21%	2150
Smart Phone Access	99%	10099	1%	152

Table 4. Computer Access at Home: Male and Female Teacher

		Yes	No
Male	2,473	2,057	416
Female	7,028	5,821	1,207
Male	26.0%	26.1%	25.6%
Female	74.0%	73.9%	74.4%

Table 5. Computer Availability in Classroom

Computer Availability in the classroom	Percentage	Count
I have computers in my classroom	40.30%	7671
My school has a computer lab that I can arrange for my students to use.	39.17%	7456
My school has a laptop cart that can travel to different spaces.	12.55%	2389
We have computers but they are old and only used for word processing.	1.10%	210
Your answer - situation concerning computer use	6.87%	1307
Total	**100%**	**19033**

Table 6. Technologies Available for Teaching

Technologies Available for Teaching	Yes		No		Total
	%	Count	%	Count	
Computer	99.69	9969	0.31	31	10000
Internet	96.24	9094	3.76	355	9449
Smart phone	80.15	6796	19.85	1683	8479
Tablet (devices larger than a mobile phone)	12.17	790	87.83	5701	6491
Projectors	99.18	9551	0.82	79	9630
Television	72.42	5781	27.58	2202	7983
Smart Board	47.26	3443	52.74	3842	7285
Other (please type)	27.42	502	72.58	1329	1831

Table 7. Type of Technology and Usage

Type of Technology	Daily		Once a week		1-4 times a month		Never		Total
	%	Count	%	Count	%	Count	%	Count	
Computer	59.48%	6031	28.98%	2938	11.08%	1123	0.46%	47	10139
Internet	60.84%	5720	26.64%	2504	10.79%	1014	1.73%	163	9401
Smart Phone	63.62%	5344	15.11%	1269	9.29%	780	11.99%	1007	8400
Tablet	3.97%	241	4.63%	281	3.77%	229	87.63%	5320	6071
Projectors	55.38%	5247	30.36%	2876	13.22%	1252	1.04%	99	9474
Television	8.70%	625	18.13%	1303	24.63%	1770	48.55%	3489	7187
Smart Board	24.26%	1633	12.30%	828	8.01%	539	55.42%	3730	6730
Other	12.43%	180	8.98%	130	10.36%	150	68.23%	988	1448

Table 8. Confidence in Using E-Mail

Answer	%	Count
Yes	95.26%	9571
No	4.74%	476
Total	100%	10047

Table 9. Frequency of concerns statements

Time	1266
Internet/Network	654
Power/Electricity	506
Training	242
Equipment	50

Kerala Government's
Hi-Tech School Programme Implementation

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OHIO UNIVERSITY

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